

A review of *Elmeriobryum* (Hypnaceae)

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Abstract

Elmeriobryum Broth. is taxonomically reviewed. Previously published synonymy is confirmed. However, material from New Guinea, usually referred to as *E. philippinense*, should better be called *E. wilhelmense* (E. B. Bartram) W.R.Buck & B.C.Tan, comb. nov.

Introduction

Elmeriobryum was first used by Brotherus (1913) for two Philippine moss species, *E. philippinense* and *E. assimile*. However, because no separate generic description was provided, the genus was not validly published until Brotherus (1925) provided a generic description in *Die natürlichen Pflanzenfamilien*. Shortly after Brotherus' original use of the name, Williams (1914) described a third Philippine species, *E. brotheri*, from one of his own collections. Oddly, the type collections of all three species were gathered at the same locality, Baguio in Benguet Province in northern Luzon. On the isotype of *E. assimile* at NY, R. S. Williams even annotated it as, "Probably not distinct from *G. [Gollania] philippinensis*." Brotherus (1928) published *E. formosanum* and its var. *minus* from Taiwan, the first record of the genus outside of the Philippines. Finally, Rohrer (1986) described the first New World species of *Elmeriobryum*, based on Central American material that had been misplaced in *Leptohymenium*.

After this flurry of new species descriptions, most subsequent work on the genus focused on reducing the number of species. In Bartram's Mosses of the Philippines (1939), *E. assimile* and *E. brotheri* were reduced to synonymy under *E. philippinense*. Noguchi (1962) added to that synonymy by including *E. formosanum* and *E. formosanum* var. *minus* in the synonymy of *E. philippinense*. However, Noguchi (1962) considered *Elmeriobryum* to be a synonym of *Gollania* and most subsequent Asian workers followed his lead. Subsequently, Rohrer (1985), in a phyletic analysis of the Hypnaceae, found that *Gollania philippinensis* was only weakly related to the other species in the genus and suggested that *Elmeriobryum* should be resurrected. Rohrer (1986) also suggested that all Asian names in *Elmeriobryum* represent a single species. Since that time, workers have considered *Elmeriobryum* to be represented in Asia by *E. philippinense* alone.

However, as time went by and additional collections were made, *Elmeriobryum philippinense* was used not only for material from the Philippines and Taiwan, where almost all collections were made below 2000 m (rarely to 2700 m) and growing on rock (rarely on tree trunks and branches), but also from Papua New Guinea (Koponen & Norris 1985). These New Guinea specimens were mostly collected above 3000 m (rarely down to 2400 m) and almost exclusively on humus and soil, often in marshy areas. The plants are decidedly larger than the Philippine/Taiwan material and there are a number of other microscopic differences as well. This material was described by Bartram (1965) as *Calliergon wilhelmense*. Despite Bartram's experience with *Elmeriobryum* in the Philippines, he never realized the congeneric relationship of his *Calliergon wilhelmense*. Subsequently, Koponen and Norris (1985) synonymized the name with *E. philippinense*, a taxonomic decision with which we disagree. We take this opportunity to make the new combination and review the species of *Elmeriobryum*.

Elmeriobryum Broth. in Engler, Die natürlichen Pflanzenfamilien, ed. 2, 11: 204. 1925; Leaflet. Philipp. Bot. 6: 1974. 1913, *nom. inval. sine descr. gen.* Type: *E. philippinense* Broth.

Plants relatively robust, \pm turgid, in somewhat shiny, golden- to red-brown to yellow-green, extensive mats. *Stems* creeping, irregularly branched, procumbent to ascending; in cross-section without a hyalodermis, with small thick-walled cells surrounding larger thin-walled cells, central strand present; pseudoparaphyllia foliose; axillary hairs consisting of 1(–2) short brown basal cells and 2–3 elongate hyaline distal cells. Stem and branch *leaves* somewhat differentiated, imbricate, erect- to wide-spreading, ovate to oblong, apiculate to short-acuminate, strongly concave, somewhat plicate; margins mostly serrulate above, entire below, plane to incurved; cells linear, smooth or minutely prorulose, thin- to firm-walled; alar cells not or somewhat differentiated. Asexual propagula none. Dioicous. Perichaetia large, leaves oblong, long-acuminate, plicate; margins subentire, plane; costa usually none; cells linear-flexuose, smooth, becoming laxly rectangular toward the insertion; alar cells not differentiated. *Setae* very elongate, smooth, reddish; *capsules* inclined, weakly arcuate, \pm asymmetric, oblong; exothecial cells subquadrate to irregularly short-rectangular, firm-walled, not collenchymatous; annulus well differentiated; operculum apiculate; peristome double, exostome teeth yellow-brown, shouldered, bordered, on the front surface with a zig-zag median line, not furrowed, cross-striolate below, coarsely papillose above, trabeculate at back; endostome with a high basal membrane, segments keeled, narrow, perforate, about as long as the teeth, cilia in groups of 1–3, nodose. *Spores* spherical, papillose. *Calyptrae* small-cucullate, naked, smooth.

Key to the species of *Elmeriobryum*

1. Plants robust, turgid, stems erect, 2–3 mm wide with leaves, typically growing on humus or soil, restricted to New Guinea 3. *E. wilhelmense*
1. Plants more slender, weakly turgid, stems creeping, 1–1.5 mm wide with leaves, typically growing on rocks or trees, Asian or Central American 2
2. Plants of Asia; stem leaves weakly plicate, c. 0.5 mm wide; costa of stem leaves 1/5–1/6 the leaf length; alar cells distinctly differentiated 1. *E. philippinense*
2. Plants of Central America; stem leaves distinctly plicate, more than 0.7 mm wide; costa of stem leaves 1/4–1/2 the leaf length; alar cells scarcely differentiated 2. *E. guatemalense*

1. *Elmeriobryum philippinense* Broth. in Engler, Die natürlichen Pflanzenfamilien, ed. 2, 11: 204. 1925; Leaflet Philipp. Bot. 6: 1974. 1913, *nom. inval.*

Type: Philippines. Luzon: Benguet Prov., Baguio, *Elmer 8374* (H-BR, holotype; NY, isotype).

Elmeriobryum assimile Broth. in Engler, Die natürlichen Pflanzenfamilien, ed. 2, 11: 204. 1925; Leaflet Philipp. Bot. 6: 1975. 1913, *nom. inval.*

Type: Philippines. Luzon: Benguet Prov., Baguio, *Elmer 8449* (H-BR, holotype; NY, isotype).

Elmeriobryum brotheri R. S. Williams ex Broth. in Engler, Die natürlichen Pflanzenfamilien, edn 2, 11: 204. 1925; R. S. Williams, Bull. New York Bot. Gard. 8: 366. 1914, *nom. inval.*; *Ectropothecium brotheri* (Broth.) Higuchi, J. Hattori Bot. Lab. 59: 69. 1985.

Type: Philippines. Northern Luzon: Benguet Prov., Baguio, 1600 m, *Williams 1728* (NY, holotype).

Elmeriobryum formosanum Broth., Ann. Bryol. 1: 21. 1928, *vide* Noguchi, Acta Phytotax. Geobot. 20: 241. 1962.

Type: China. Formosa: Prov. Taityn, Onae, *J. Suzuki* (H-BR, holotype, not seen).

Elmeriobryum formosanum var. *minus* Broth., Ann. Bryol. 1: 21. 1928, *vide* Noguchi, Acta Phytotax. Geobot. 20: 241. 1962.

Type: China. Formosa: Prov. Taityn, Onae, *J. Suzuki* (H-BR, holotype, not seen).

Plants relatively robust, in shiny, golden-brown to yellow-green, extensive, loose mats. *Stems* to c. 10 cm, creeping, elongate, irregularly and distantly 1–2-pinnately branched; in cross-section with 2–3 rows of small thick-walled cells surrounding abruptly larger thin-walled cells, central strand of small thin-walled cells; pseudoparaphyllia broadly foliose; axillary hairs consisting of 1(–2) short brown basal cells and 2–3 elongate mostly pale yellow, rarely hyaline distal cells. Stem and branch *leaves* somewhat differentiated; stem leaves 1.0–1.4 mm long, c. 0.5 mm wide, erect to erect-spreading when dry, spreading when moist, broadly ovate, abruptly tapered to a broadly short-acuminate, recurved, often twisted apex, strongly concave, not plicate; margins serrulate in the acumen, subentire below, plane to narrowly recurved at base, plane or broadly inrolled above; costa double, the two forks separated at base and spreading, extending $\frac{1}{6}$ – $\frac{1}{5}$ the leaf length; cells 34–48(–56) \times c. 3 μ m, narrowly linear, somewhat flexuose, firm-walled, not or weakly porose, smooth, basal cells wider, thicker-walled, porose; alar cells restricted to extreme basal corners, irregularly short-rectangular, thick-walled, concolorous with cells above, in c. 6–7 rows, extending up the margins by 4–5 cells. Branch leaves c. 0.8 mm long, 0.3 mm wide, ovate. Asexual propagula none. Dioicous. Perichaetia large, leaves to 3 mm long, erect, slightly plicate, ecostate; margins entire or minutely serrulate above. *Setae* to 3 cm long, smooth, reddish; *capsules* inclined to horizontal, 2–2.25 mm long, subarcuate, contracted under the mouth when dry and empty; exothecial cells isodiametric to short-rectangular, thin- to firm-walled, becoming small-quadrate to oblate and thick-walled in 3–5 at the mouth; annulus broad, of 2 rows of thick-walled cells, the lower (attached to urn) small, quadrate, the upper (attached to operculum) rectangular, \pm inflated; operculum conic-mammillate; exostome teeth on front surface cross-striolate below, coarsely papillose above, trabeculate at back; endostome with a high, smooth basal membrane, segments finely papillose, keeled, narrowly perforate, about as long as the teeth, cilia in pairs, very short. *Spores* 22–25 μ m in diameter, papillose. *Calyptrae* cucullate, naked, smooth.

Selected specimens studied: PHILIPPINES. Luzon: Benguet Prov., Merrill 7825, 7835, 7842, *Fé-nix* 12943 (all NY), Baguio and vicinity, *Robinson* 11999 (NY), near Baguio, *Williams* 1729 (NY), between Baguio and Mt. Santo Tomas, *Williams* 1706; Mountain (=Bontoc) Prov., *Vanoverbergh* 598, 1318 (NY), Mt. Sto. Tomas, *Cuevas* 6150 (NY), Banguio, near road to airport, *Bartlett* 13365 (NY); Bontoc Prov., near Bontoc, 6000 ft, *Mack* 1402 (NY); Ifugao Prov., Mt. Polis, *McGregor* 20309 (NY). TAIWAN. Hualien Co.: Tzuen, c. 2000 m, *Lai* 13532, 13593 (NY). Ilan Co.: Chilan, *Lai* 12277 (NY). Nantou Co.: Chitou, c. 1100 m, *Lai* 11571, *Liu*, *Bryophytes of Taiwan* no. 68, *Ogasawara et al.*, *Bryophyta Exsiccata* no. 116 (all NY).

Distribution and ecology: Philippines, Taiwan; growing at 1200–1900(–2700) m, mostly on rocks but sometimes on tree trunks and branches.

Discussion: *Elmeriobryum philippinense* is a handsome plant, and quite similar in aspect to *E. guatemalense*, and not at all like *E. wilhelmense*. From *E. guatemalense*, it can be separated by smaller leaves with shorter but narrower laminal cells. The costa is distinctly shorter and the alar region is better differentiated. From *E. wilhelmense*, it can be separated by the creeping as opposed to erect stems that are more slender and less turgid, by the narrower stem leaves with a flat apex, and by thinner-walled laminal cells.

One of the synonyms of *E. philippinense*, *E. brotheri*, was transferred to *Ectropothecium* by Higuchi (1985) on the basis of a few gametophytic characters, the most compelling being the “few small cells with a few enlarged hyaline cells at the angle of alar parts of stem-leaves.” However, these basal cells are thick-walled in *Elmeriobryum*, not thin-walled as in *Ectropothecium*. Presumably Higuchi (1985) did not have sporophytes in making his decision. In *Ectropothecium* the capsules are very small, almost spherical, and seldom more than about 1 mm long. Here, the capsules are arcuate-cylindrical and over 2 mm long, readily excluding the plants from *Ectropothecium*.

2. *Elmeriobryum guatemalense* J. R. Rohrer, *Bryologist* 89: 29. 1986.

Type: Guatemala. San Marcos: Barranco Eminencia, road between San Marcos and San Rafael Pie de la Cuesta, in upper part of the barranco between Finca La Lucha and Buena Vista, 2500–2700 m, 6 Feb 1941, *Standley* 86466 (MICH, holotype; F, FH, NY isotypes).

Plants relatively robust, in shiny, golden-brown to yellow-green, extensive, loose mats. *Stems* to ca 10 cm, creeping, elongate, irregularly and distantly 1–2-pinnately branched; in cross-section with 2–3 rows of small thick-walled cells surrounding abruptly larger thin-walled cells, central strand of small very thin-walled cells; pseudoparaphyllia foliose; axillary hairs consisting of 1 short brown basal cell and 2 elongate hyaline distal cells. Stem and branch *leaves* somewhat differentiated; stem leaves 1.0–1.8 mm long, 0.7–1.4 mm wide, erect to erect-spreading when dry, spreading when moist, broadly ovate to oblong, abruptly apiculate, concave, plicate; margins serrulate above, entire below, reflexed at base, plane or broadly inrolled above; costa double, the two forks separated at base and \pm parallel, extending $1/4$ – $1/2$ the leaf length; cells 25 – 75×4 – $7 \mu\text{m}$, narrowly elliptic to linear, smooth or sometimes minutely prurulose, basal cells wider, porose; alar cells scarcely differentiated, slightly wider than other basal cells. Branch leaves 1.0–1.5 mm long, 0.4–0.7 mm wide, ovate to elliptic, less plicate than stem leaves. Asexual propagula none. Apparently dioicous. Perichaetia and *sporophytes* unknown.

Selected specimens examined: GUATEMALA. Guatemala: Volcán de Pacaya, *Standley* 80724 (F, FH, MICH, US). Quezaltenango: El Pocito, S of San Martín Chile Verde, *Standley* 85043

(F, MICH, NY). **San Marcos:** Barranco Eminencia, *Standley 68524* (F, FH). **Sololá:** Volcán Atitlán, *Steyermark 47464* (F, FH, MICH, NY, TENN). **EL SALVADOR.** **Santa Ana:** Cerro Miramundo NW of Metapán, *Carlson 962b* (F, FH). **COSTA RICA.** **Heredia:** Volcán Barba, *Griffin et al. D-268* (CANM, F, MO, NY).

Distribution and ecology: Guatemala, El Salvador and Costa; growing on tree trunks and branches and moist rocks and roadbanks in cool, moist forests, at 1800–3100 m.

Discussion: this little-known species was formerly confused with *Leptohymenium* (Hylocomiaceae), but was resolved by Rohrer (1986). Unlike *Leptohymenium* and the rest of the Hylocomiaceae, the branching in *Elmeriobryum* is monopodial rather than sympodial, and the leaves are not at all decurrent with the alar cells scarcely if at all differentiated. This New World species differs from its Asian counterpart, *E. philippinense*, by the leaves more strongly plicate, with an apiculate rather than acute apex, and a stronger costa. Also, in *E. guatemalense* the alar cells are more poorly differentiated.

3. *Elmeriobryum wilhelmense* (E. B. Bartram) W. R. Buck & B.C. Tan, *comb. nov.*

Calliargon wilhelmense E. B. Bartram, *Contr. U.S. Natl. Herb.* 37(2): 60. 1965.

Type: New Guinea. Eastern Highlands District: Mt. Wilhelm, east slopes, 13,100 ft, coll. J. D. Collins (*Brass 29943*) (US, holotype).

Plants robust, in shiny, red- to golden-brown to yellow-green, extensive, loose tufts. *Stems* to c. 5 cm, erect, irregularly and distantly 1-pinnately branched, turgidly foliate; in cross-section with 2–3 rows of small thick-walled cells surrounding abruptly larger thin-walled cells, central strand of small thin-walled cells; pseudoparaphyllia broadly foliose; axillary hairs consisting of 1(–2) short brown basal cells and 2–3 elongate yellowish, rarely hyaline distal cells. Stem and branch *leaves* somewhat differentiated; stem leaves 1.25–2.0 mm long, 0.75–0.9 mm wide, erect to erect-spreading when dry, spreading when moist, broadly ovate, abruptly shortly broad-apiculate, strongly concave, not plicate; margins serrulate in the acumen, subentire below, plane to erect at base, plane or broadly inrolled immediately below apiculus; costa double, the two forks separated at base and spreading, extending $\frac{1}{5}$ – $\frac{1}{4}$ the leaf length; cells 48–57 μm long, lumina c. 3 μm broad with walls as thick or thicker than the lumina, narrowly linear, somewhat flexuose, thick-walled, \pm porose, smooth, basal cells shorter, wider, thicker-walled, porose; alar cells restricted to extreme basal corners, subquadrate to short-rectangular, thick-walled, concolorous with cells above or dark red, in c. 6–8 rows, extending up the margins by 3–5 cells. Branch leaves 1–1.2 mm long, 0.4–0.65 mm wide, oblong-ovate. Asexual propagula none. Apparently dioicous. Perichaetia and *sporophytes* unknown.

Specimens examined: PAPUA NEW GUINEA. **Chimbu Prov.:** Massif du mont Wilhelm, rive sud du lac Piunde, 3500 m, *De Sloover 42896*, *Herbier Bryologique no. 757* (NAM, NY), rive est du lac Piunde, 3500, *De Sloover 42737*, *Herbier Bryologique no. 708* (NAM, NY). **Morobe Prov.:** Mt. Sarawaket Southern Range 2.5 km S of L. Gwam and E of Mt. Enggum, headwaters of Sankwep R., 6°21'S, 147°07'E, 3500–3570 m, *Koponen 32742* (H, NY), 4 km E of L. Gwam, 6°19'S, 147°09.5'E, 3100–3200 m, *Koponen 32870* (H, NY); Lake Wamba 5 km S of Teptep airstrip, 6°01'S, 146°33'E, 2430 m, *Koponen 33279* (H, NY). **Simbu Prov.:** Kombugomambuno, 4 km SE of Mt. Wilhelm, 5°48'S, 145°08'E, *Mundua 78* (CBG, NY); Lake Aunde, 3 km SE of Mt. Wilhelm, 5°47'S, 145°07'E, 3660 m, *Mundua 108* (CBG, NY). **Southern Highlands Prov.:** Massif du mont Giluwe, entre Karil (15 km au NE de Mendi) et le sommet, 3100 m, *De Sloover 43082* (NAM, NY). **West Sepik Distr.:** Star Mts, Silil'katibin, NW of Mt. Auriga, c. 5°S, 141°05'E, 3500

m, *Touw* 16652, 16658 (L, NY); SW of Mt. Capella Base Camp, c. 5°S, 141°05'E, 3400 m, *Touw* 16590 (L, NY).

Distribution and ecology: Papua New Guinea endemic; growing on moist soil or humus, often in open, swampy habitats, at (2400–)3100–4000 m.

Discussion: this handsome plant differs from the other two species in its erect growth habit, usually in open, swampy habitats, as opposed to creeping in moist forests. The plants are very turgid and the leaves are broadly ovate. The laminal cells are very thick-walled, with the walls as wide as or wider than the lumina. Like *E. philippinense*, *E. wilhelmense* has reasonably well-developed alar cells. However, the very different habit (and habitat) and the incrassate laminal cells will readily separate it. From an Australian perspective, *E. wilhelmense* recalls the ACT endemic, *Bryostreimannia turgida* (Ochyra) Ochyra, both in terms of the turgid aspect and the swampy habitat. However, that plant is a pale green rather than the often reddish tinge exhibited in *E. wilhelmense*. Additionally, in *B. turgida* the leaves are less concave and more long-acuminate. The most significant differences, though, are in the alar region. In *E. wilhelmense*, the alar cells are few, small, and thick-walled. In *B. turgida*, the alar cells are quite numerous and often have an excavate area of hyaline, inflated, thin-walled cells (not unlike many other Amblystegiaceae). From the North Temperate *Pseudo-calliargon turgescens* (T. Jensen) Loeske (also Amblystegiaceae), *E. wilhelmense* differs by the non-calcareous habitat, broader leaves, larger alar cells and non-porose upper laminal cells.

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